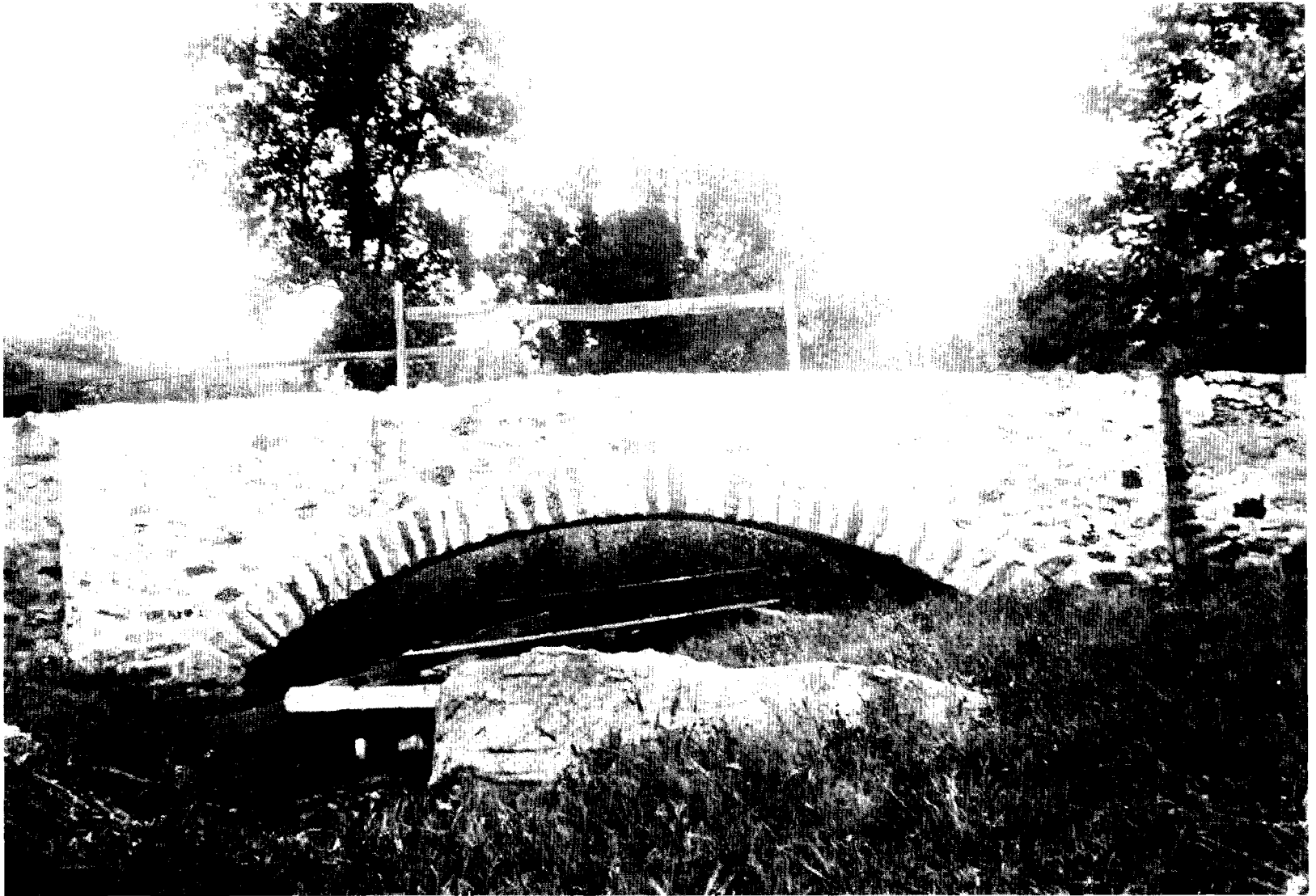


STONE ARCH BRIDGES



Stone Arch bridge on Way Road in New Castle County in 1921. (No longer standing).

STONE ARCH BRIDGES

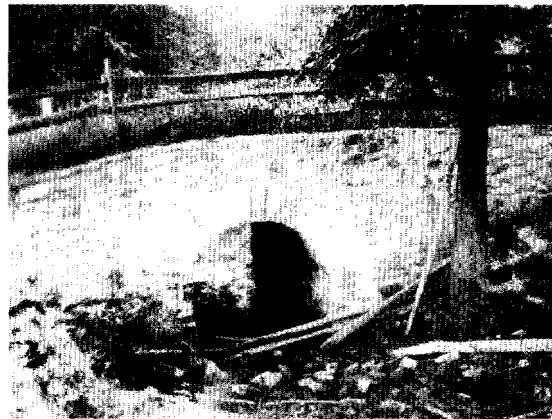
There were four stone arch roadway bridges included in the present survey; all of them were considered to be significant as representatives of a rare historic resource which is disappearing. All these stone arches still carry vehicular traffic. Three are located in New Castle County, and the fourth is in Kent County.

Delaware Department of Transportation photographic archives for



*Brick and stone arch bridge.
Below Middletown, New Castle County
No longer standing.*

New Castle County illustrate the existence of approximately twenty stone arch bridges and culverts in that county in the 1920s. No such records remain for Kent and Sussex County. All were constructed of uncoursed or semi-coursed rubble. The bridges illustrate arch rings and voussoirs which are typically more refined than the spandrel walls, as seen in the photograph on the preceding page. Occasionally an oversized keystone will be used for emphasis, as seen below. Several of the bridges had brick arch rings, also seen below. Span lengths varied from 5'-0" to 20'-8" (10'-3" to 20'-6" for the five extant) and only one two-span bridge was noted

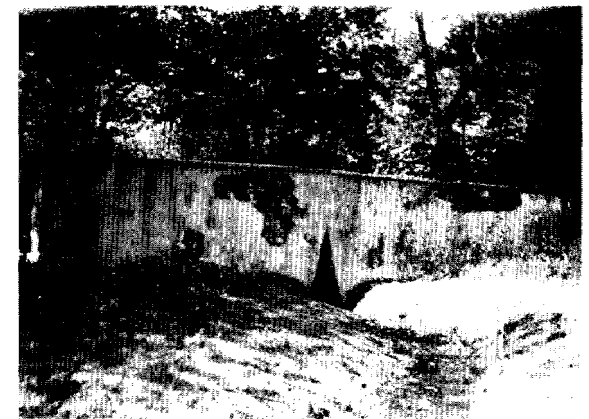


EARLY STONE BRIDGES OF NEW CASTLE COUNTY

*Stone arch with accentuated keystone.
Near Thompsons Station and Pennsylvania Line,
New Castle County. No longer standing.*

(no longer standing). Most were undocumented with respect to construction dates, although the New Castle County Photo Archives noted one bridge built in 1805 on Concord Pike (photo in following pages), one built in 1846 (photo in following pages) and one built about 1875. Among the most unusual stone structures in the photo archives is a 1817, 3'-0" masonry culvert, pictured below, notable as an example of a corbelled arch, a rudimentary "arch" constructed of stone courses which project to a peak, resulting in a triangular shape.

The relatively low number of stone



*Corbelled stone culvert, built 1817.
Near Centerville, New Castle County
No longer standing.*

STONE ARCH

arch bridges in Delaware, both recorded and remaining, correspond to the conclusions drawn by historians of technology: early stone masonry structures seem to be poorly represented in the United States. Bridge engineer and historian, J.A.L. Waddell concluded so, in his 1917 Bridge Engineering:

"Stone arch bridges have played a very small part in bridge evolution in America....but stone and brick were for many years the principal materials for substructures."

Technological historian Carl Condit echoed, in his 1968 book, American Building:

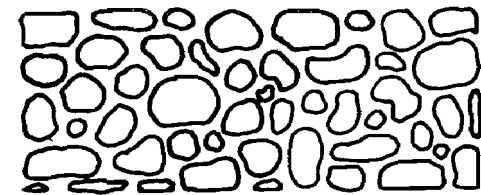
Arch bridges of stone were extremely rare in the colonies, and reliable records are nonexistent. There is scarcely any evidence for the construction of stone bridges in the seventeenth century, and there is little to suggest the exact form of those built in the eighteenth....(however) there was a steady progress in the art during the late colonial period...(and)..Construction in stone masonry continued to flourish in the first half of the nineteenth century, but thereafter its role was progressively superseded by iron and concrete.

Most stone bridges for early American roadways appear to have been constructed of rubble masonry. Condit cited the 1829 Baltimore and Ohio Railroad's Carrollton Viaduct in Baltimore as the first stone bridge in the United States constructed of highly dressed stone and uniform mortar joints. This bridge was followed by the B & O's 1835 Thomas Viaduct in Relay, Maryland. Both are large-scale, well-engineered railroad structures of high quality, singled out as early exceptional examples of ashlar construction in the United States.

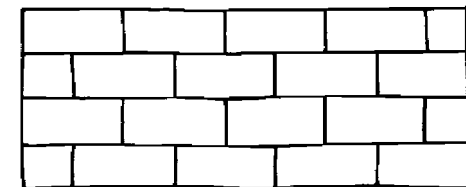
Construction of America's early stone bridges was accomplished by skilled craftsmen, masters who continued a centuries-long tradition. Bridge petitions by area residents often cited their preference for an enduring stone bridge, as the alternative was a timber span. Even by 1900, when empirical knowledge of arch design was established, texts were published, and professional specifications had been published, construction of durable stone bridges still depended on correct design, thorough knowledge of building materials and careful craftsmanship.

Stonework is often classified by the craftsman's surface treatment of the individual stones used for construction. Three general categories can be

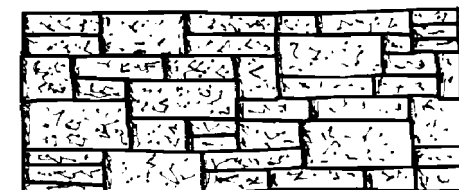
distinguished: rubble, squared-stone, and ashlar. Rubble masonry consists of rough stones which have not been finished or tooled; squared masonry consists of stones which have been roughly finished, squared and tooled to some rectilinear shape; and ashlar masonry consists of stones which have been squared, and then tooled to a more refined finish. An assortment of tools was used to create a variety of surface treatments.



RUBBLE



SQUARED STONE



ASHLAR

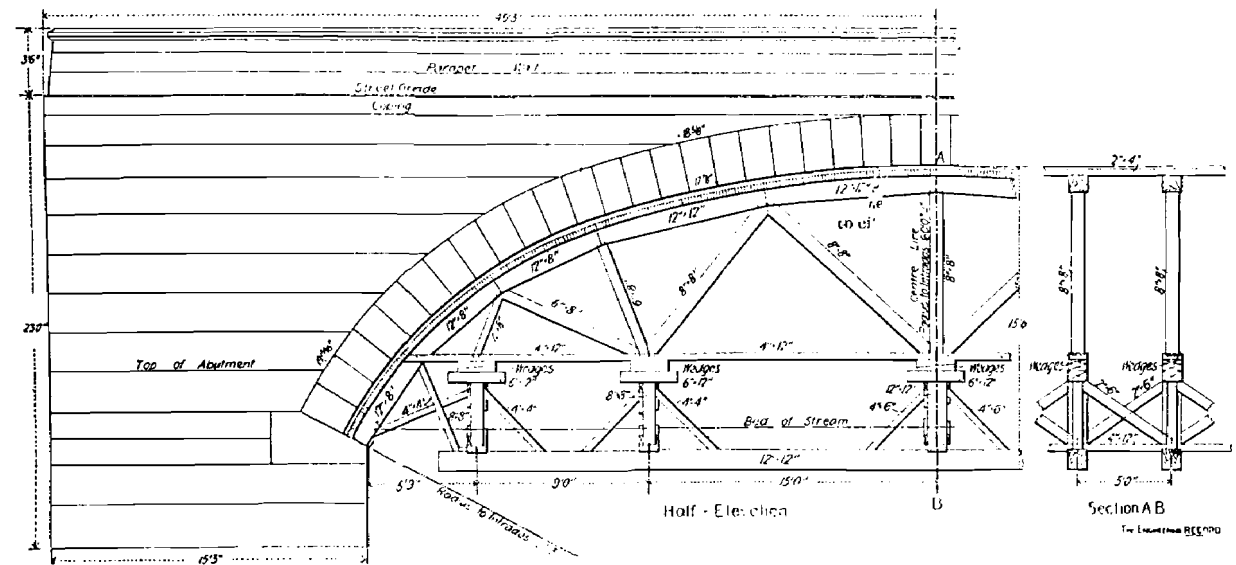
Decorative treatment can consist of refined surface treatment of individual stones, as well as stylistic treatment of the bridge, itself. Diversity in design included type of stone coursing, shaped piers, belt courses, marble plaques, highly dressed voussoirs, carved keystones, and brick arch rings.

The components of masonry arch bridges, both stone and brick and then later, the plastic masonry -- concrete, are described using the same terminology. The arch ring itself, carrying the loads and distributing them to the substructure, is constructed after the substructure has been completed, on temporary centering which spans from spring-line to spring-line. This is shown in a drawing of a nineteenth century highway bridge shown adjacent; the drawing also illustrates the terminology. For stone and brick arches, the ring consists of radiating units, often wedge-shaped, which are called voussoirs. The center voussoir, at the crown of the arch, is the keystone. Spandrel walls are built upon the arch at the outermost edges, these walls often extend above the roadway surface, forming the bridge parapet wall.

As noted previously, from the known Delaware examples, most early stone bridges seem to have been constructed of rubble masonry. Examples of ashlar

masonry exist on Delaware railroads, and in highway bridges built in the twentieth century. According to Condit, most stone highway bridges built after 1900 are probably stone-faced concrete or steel, although railroad companies continued to build dressed masonry bridges beyond that date. The use of stone facing for post-1900 concrete and steel highway bridges is reflected in the surveyed Delaware bridges, as illustrated in the sections dealing with concrete bridges and steel girder bridges. The continued construction of ashlar bridges by the railroads after 1900 is also represented in Delaware. There were a number of stone railroad bridges inventoried during the course of this survey; evaluation of those structures, however, was beyond the scope of this study.

Several of the stone arches were associated with the construction of New Castle turnpikes. Delaware maps for the nineteenth century show an incipient network of roads in New Castle County, precursors of a few present-day roads, as early as 1800. During the first quarter of the nineteenth century, the network grew as roads were upgraded or expanded with the construction of turnpikes. A total of approximately 65 miles of turnpike was built in the county during that period; among the turnpike companies chartered in New Castle County were the 1808 Newport-Gap, Pennsylvania Turnpike, the 1809 New Castle and Frenchtown and the 1823 Wilmington and Philadelphia. Additional roadway history is presented in Part III, History of Delaware's Highways.



BUILDING A SMALL STONE HIGHWAY BRIDGE.
MR. J. F. FIRTH, CHICAGO, ILL., ENGINEER.

Nineteenth century drawing illustrating arch terminology and centering.

STONE ARCH

The 1920s New Castle County photo archives at Delaware Department of Transportation illustrate four bridges attributed to turnpikes, two on Concord Pike and two on Lancaster Pike; both were small, single span, rubble masonry structures. Some examples are presented in the adjacent photographs. Built prior to 1811, the Concord Pike connected Wilmington with West Chester, Pennsylvania and the farmlands of the Great Valley. The Lancaster Pike, also known as the Gap and Newport Pike, was chartered in 1808 to link Newport and Christiana to the major turnpike between Philadelphia and Lancaster, Pennsylvania. This turnpike was a cooperative venture, under which Delaware parties funded and built the section from Newport to the state line.

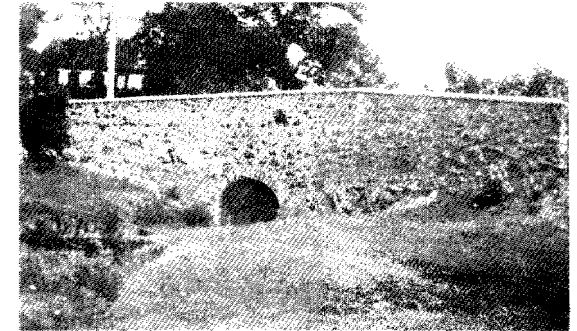
The 1805 Concord Pike bridge, pictured on this page with several other undated examples from the photo archives illustrate the "hump-back" form common among turnpike bridges built in the first quarter of the nineteenth century. Also represented in the photo archives is one exceptional, two-span arch bridge with stylistic similarities to the multiple span turnpike bridges of Pennsylvania and western Maryland; this bridge appears to have conical piers, a belt course and corbelled capstone on the parapet, similar to other Mid-Atlantic bridges. A photograph

of the old two-span bridge appears on this page.

There are a number of extant stone arch roadway bridges in adjacent Pennsylvania, including several extremely early examples. They were built on both king's highways and turnpikes, and their distribution corresponds to the availability of local sources for building stone. This appears to be true in Delaware, where the geology of New Castle County offered a source of building stone and lime for mortar, as fieldstone and limestone were available in the Piedmont region. The use of stone as a building material can be said to distinguish northern New Castle County from the lower portions of the state.

Also reflected in Delaware is the widespread use of masonry for bridge substructures. While there are relatively few stone arch highway bridges, masonry piers and abutments remain throughout the state, often incorporated into the design for replacement bridges. Some are illustrated in the sections dealing with timber, metal truss, and early steel girder bridges.

All of the surveyed Delaware DOT-owned stone bridges were determined to be significant, as remaining examples of a disappearing historic resource. They are illustrated in the following section.



*Stone arch turnpike bridge.
Lancaster Pike near Hockessin,
New Castle County. No longer standing.*



*1805 Stone arch turnpike bridge.
Concord Pike, New Castle County
No longer standing.*



*Two-span stone arch bridge.
Between Newport and Wilmington,
New Castle County. No longer standing.*



State Bridge 39C

STATE BRIDGE NUMBER 39C

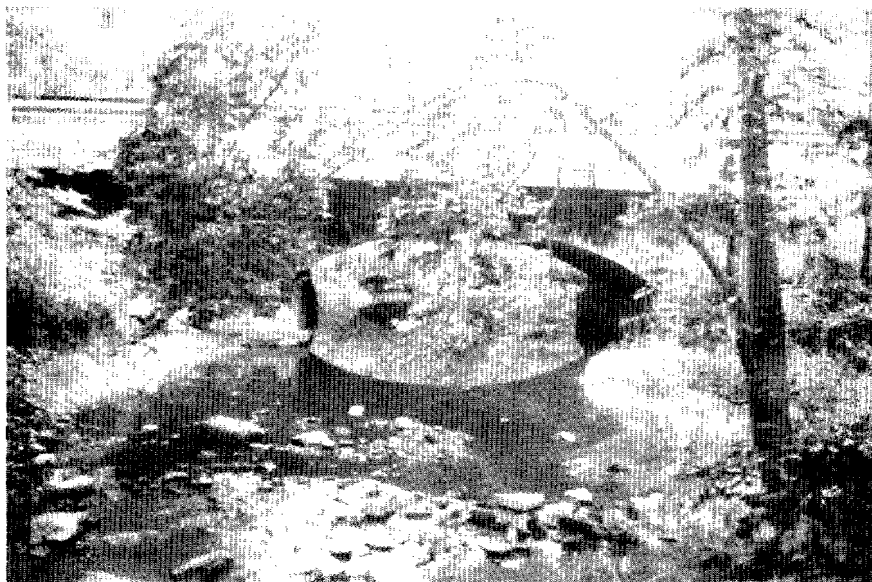
Route 6 over Duck Creek Smyrna, Kent County, Delaware

State Highway Bridge 39C is a single span stone arch bridge combining vehicular and railroad use. The bridge carries two lanes of traffic, a sidewalk on the south, and on the north elevation, a single railroad track. The section supporting the railroad track is a concrete pipe culvert with a concrete headwall. The south elevation is an arch of uncoursed rubble. The east wing wall is straight and of stone, semi-coursed rubble, while the west wing wall is U-shaped and constructed of concrete. Built on a skew, the arch has a clear span of 11'-0" and a rise of 4'-6".

Delaware Department of Transportation records do not document the date of construction for Bridge 39C. Original drawings are not available.

Bridge 39C is the only stone arch highway bridge in Kent County. Although alterations have obscured some of this bridge, the configuration of the body of the bridge remains visible.

STONE ARCH



State Bridge 177



State Bridge 177 as it appeared in 1921.

STATE BRIDGE NUMBER 177

**Brackenville Road over Mill Creek
Gateway Farms, New Castle County,
Delaware
c. 1840/1965**

State Highway Bridge 177 is a 20'-0" single-span stone arch bridge. The voussoirs consist of radiating bricks; the barrel was constructed of rubble, as were the spandrel walls. A galvanized guard rail serves as a parapet. The deck is 24'-0" wide and carries two lanes of vehicular traffic. The abutments and wing walls are partially parged semi-coursed rubble, with

U-shaped wing wall configuration. A concrete overhang is the most visible evidence of a 1965 alteration.

The stone bridge over Mill Creek was originally constructed as a single-span stone arch in 1846 as noted in the photo archives at Delaware Department of Transportation (see photo above). In 1965, the bridge was altered when the narrow structure was widened to 24 feet. The parapet walls were torn down and a reinforced concrete slab was cast. The original structure is recognizable despite

this radical alteration. Drawings dated June 1925 prepared by the Office of the New Castle County Engineer direct the reconstruction of a rubble masonry wing wall for Bridge 177. These drawings document the parapet wall which was removed in the 1965 widening, indicating that the stone-capped parapet rose approximately 3' above the road.

A solid masonry arch bridge, Bridge 177 is an example of the type of structure associated with nineteenth century turnpike construction in the Mid-Atlantic region.



State Bridge 330

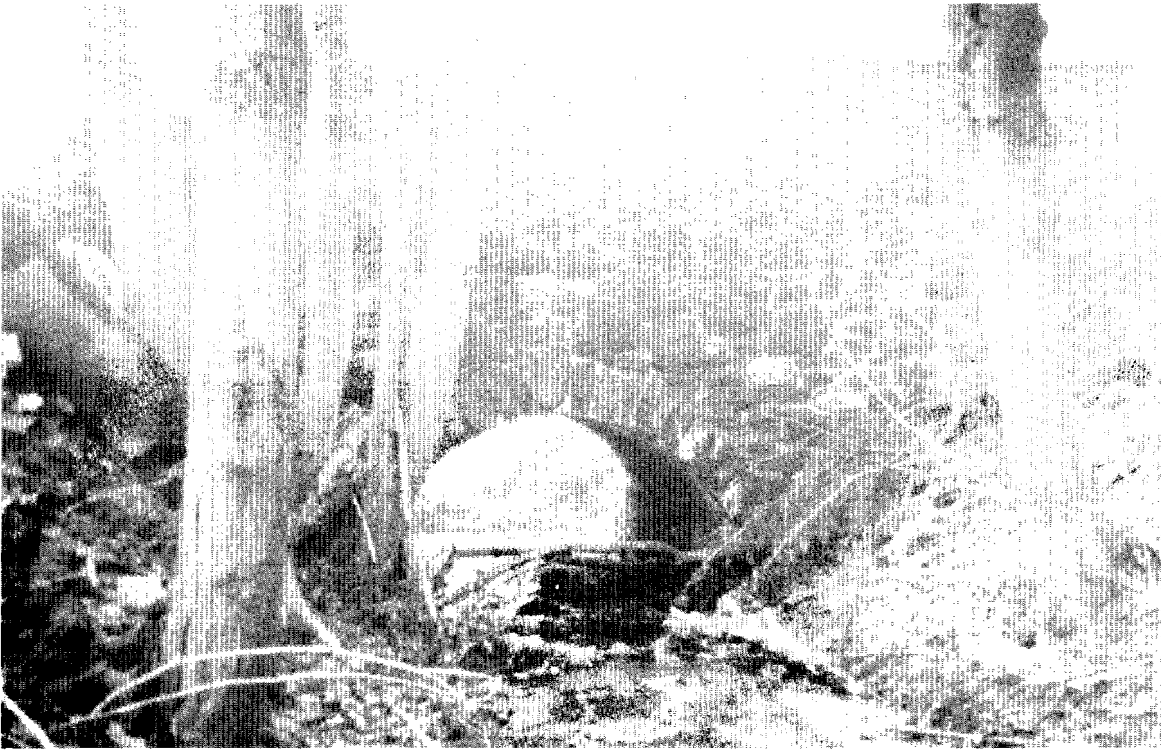
STATE BRIDGE NUMBER 330

**Marrow's Road over Cool Run
Brookside, New Castle County, Delaware**

State Highway Bridge 330 is a 13'-0" stone arch span, carrying two lanes of traffic with an overall width of 56'-6". The barrel of the arch is lined with corrugated steel. The abutments and wing walls were constructed of ashlar; decorative voussoirs and an oversized keystone define the arch, and the masonry spandrel walls form a parapet which is capped with concrete and carries a railing fabricated from 4" steel pipe. The bridge appears unaltered and in good structural condition.

Delaware Department of Transportation records for Bridge 330 do not document the date of construction. Drawings are not available at the Department.

STONE ARCH



State Bridge 617

STATE BRIDGE NUMBER 617

**Old Lancaster Pike over Waterway
Montgomery Woods, New Castle County,
Delaware**

State Highway Bridge 617 is a 10'-3" stone arch span, constructed on approximately a 10-degree skew; it carries two lanes of traffic on a 23'-0" wide deck.

The abutments and flared wing walls are constructed of rubble masonry, with a rubble keystone and voussoirs defining the arch. The spandrel walls form a parapet, which is capped with concrete. Field investigation indicates that the bridge has been widened on both sides, but the workmanship suggests this occurred during the historic period.

Delaware Department of Transportation records for Bridge 617 do not document the date of construction and drawings are not on file at the Department.

Although it is in deteriorated condition, Bridge 617 is significant as one of four historic stone arch roadway bridges owned by Delaware Department of Transportation. The original construction of Bridge 617 appears to have been associated with the Newport-Gap Turnpike, later known as the Lancaster Pike. The first turnpike chartered by the Delaware General Assembly, this road was authorized on January 30, 1808. Upon its completion, this road was cited as the first turnpike not only in Delaware, but in the nation. The route ran from Newport, Delaware to Gap Tavern in Lancaster County, Pennsylvania, to link with a toll road to Philadelphia. The Newport-Gap Turnpike represented an important commercial link between Lancaster County, Pennsylvania and New Castle County, Delaware. This turnpike provided a direct, maintained route between the farms of Lancaster County and the ports of Wilmington and Newport. Access to these ports stimulated the trade economy of both areas.



State Bridge 617 on the Old Lancaster Pike, New Castle County.